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INSTITUTIONAL POLICIES ON INTELLECTUAL PROPERTY AND TECHNOLOGY TRANSFER. 2) PRACTICAL EXPERIENCES OF INSTITUTIONAL MECHANISMS FOR UNIVERSITY–INDUSTRY RELATIONS

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[*] The opinions expressed in this paper are those of the author and do not necessarely reflect the position of WIPO and/or ECLAC.

I. INTRODUCTION

1. The relationship between universities and industry is a topic of our times. In the past, universities and industry have been able to co-exist and to relate to each other in a reasonably ad hoc manner without too much concern on either side. At the beginning of the new millennium as this relationship has become core to the delivery of competitive advantage in the economy, it has come under increasing scrutiny. This paper describes the facets of that relationship; the frictions which arise within it and provides some practical examples of ways in which the benefits may be delivered and the barriers crossed.

II. THE EMERGENCE OF DIVERGENCE

2. Universities are ancient institutions, some dating back long before the industrial revolution. For example, the University of Glasgow in Scotland, where I worked for over five years, was founded in 1451 (forty years before Columbus landed in America). It was established by a Papal Bull from the University of Bologna in Italy and was established to train the clergy for the Church. The University of Glasgow, like others in Europe, is a self-governing, independent institution and although funded by the Government, is not subordinate to it. Universities grew in a collegiate fashion with professors deciding which courses they would offer to students and this tradition of collegiality continues to be reflected in the management and organisation of universities to this day.

3. The “old” universities traditionally provided education for the elite in classical courses such as natural philosophy, classics and the arts, with only a small proportion of the population obtaining degrees. In the UK in the 1960’s several “new” universities were established to cater for more technically-based subjects. These “new” universities and the polytechnics were all re-named Universities in the late 1980’s with the removal of the “binary divide”. From the 1960’s onwards in the UK, universities began to be looked toward for the production of “trained” manpower beyond their role in the provision of those entering vocational professions such as medicine, law and divinity. It was at this time the first major divergence with industry begun to be evident. In the USA, where the Land Grant Universities were established to provide access to higher education, irrespective of wealth, to educate and train the professional cadres of industrial and urban society, and to strengthen democracy, the divergence has emerged more recently.

4. It has been in the last decade however that major expectations have been universally placed on Universities in relation to their contribution to national economies. As the economies of the advanced nations have shifted from heavy manufacture to the “weightless” economy and the world has moved from the post-industrial era, through the information age to the knowledge economy, then universities have become increasingly important to competitive advantage. Their roles can be seen to be described under three headings: the provision of human capital; the creation of new knowledge; and the output of leading edge technologies embedded in protected intellectual property.

5. At the same time there have been major changes in the way in which countries have sought to provide trained manpower, research and inventions. These changes in turn have had dramatic impacts on universities and their perceived role in economy and society.

6. As described, universities were established with a central role of education, producing individuals whether for the Church, medicine or the judiciary. However, with the move towards mass education at a higher level and the advent of life-long learning, universities have come under increasing pressure to amend their approach to course provision and to adapt their courses and methods of teaching to suit a "manpower training model" rather than a general education paradigm. In addition, there has been a shift towards a "customer- driven" model to ensure the attraction of sufficient numbers of students which may produce additional strains in relation to views of industry regarding the appropriateness of the output of university graduates. For example, the increase in the numbers of students completing courses in media studies or sports science rather than in traditional engineering or chemistry.

7. Research and the production of new knowledge is a traditional role but as pressures on university funding have grown so there has been an increasing expectation that more research will be undertaken on the basis of contracts from industry. This has led to new pressures, such as challenges to academic freedom and the involvement of universities in detailed negotiations regarding deliverables, timescales, ownership of results and restrictions on publication.

8. More recently still, the focus in the economy on technology innovation and the role models emerging from the heady days of Silicon Valley have led to demands that universities become more adept at identifying potential new technologies from their research and managing its protection and exploitation. This activity which was enshrined by the Bayh Dole act in the USA has come to be known in the UK as the "Third Mission" or "Third Stream" of university activity.

9. Each of these functions hold the potential for profitable relations between universities and industry, yet each in turn faces difficulties in practice.

III. UNIVERSITY–INDUSTRY RELATIONS: EXPECTATIONS AND REALITIES

10. Universities and industry have fundamentally different objectives and motivations. This fact underlies the clash of cultures which often beset their working relationships. Industry by its nature is focused on creating value for shareholders and as such views the "inputs" from universities as contributing to their market advantage and profitability. Industry is driven by deadlines, market share and confidentiality. Universities are driven by discoveries, excellence and dissemination of knowledge. While these drivers need not be in conflict or opposition, they lead to sufficient differences to create tensions in the underlying approach and the perceptions and attitudes which prevail between universities and industry.

11. The Universities' role in the provision of human capital was the first area where relations with industry were subject to strains and yet in a recent report into University - Industry relations in the UK[1] the provision of "human capital" is clearly seen as one of the major benefits of interaction with universities by industry. Out of the five areas quoted in the Lambert report as being extremely positive in the relationship, four relate to human capital aspects including the development of skilled personnel for business and industry. These

[1] The Lambert Review of Business-University Collaboration, Interim Report and Submissions, London, 2003

include not only the provision of highly skilled and well trained graduates and post-graduates but also the availability of skilled scientists and researchers. In addition, industry saw the provision of training for its employees (continuing professional development – CPD) and the international networks which most academics have as being extremely positive contributions to their requirements.

12. There seems little doubt that the traditional "educational" role of universities is accepted as being positive and of value to industry. This is not to say however, that there is complete satisfaction in this relationship. For many years there has been a tension between universities' views that their role is to develop well-rounded, thinking individuals as graduates and industry's view that graduates need to be "trained" in the specific skills needed for their work. Initiatives which have sought to square this circle have frequently failed on the basis that industry has been unable to specify its requirements, thus confirming the University view that the best role they can play is to provide graduates who have the ability to be trained in the workplace after their degree. An example of an initiative to bridge the gap will be given later in the paper.

13. Research and the creation of new knowledge is undoubtedly a major area of attitude and culture clash. For researchers whose career path is in the university system, progression and promotion are dependent on uncovering new understanding in their chosen field and publishing articles in peer reviewed journals. This is how they are judged, not only in relation to their standing in their chosen profession, but also in terms of their route for promotion. In addition, research in universities is leading edge and often far from the market needs of industry. In both the USA and the UK, as industry has pulled back from undertaking its own fundamental research, it has become ever more reliant on universities to provide breakthroughs which can lead to competitive advantage. The drug development chain for the major pharmaceutical companies is an excellent example of the reliance on universities to provide many of the new leads in this space of the market. At the same time as government funding for university research has become more pressured, Universities are being increasingly forced to look to industry for an increasing proportion of their research money. University and industry is therefore being forced together in a "deadly embrace" which is probably not of either's choosing. Such relationships are never easy and indeed have been the subject of serious concern. An article in Atlantic Monthly[2] in 2000 recorded serious concerns about the emerging relationships between universities and industry and the danger that these were beginning to undermine the paramount value of higher education per se.

14. The Kept University highlighted concerns that the developing relationship was threatening the underlying freedom of universities; challenging their independence; creating institutional conflicts of interest; and driving their research agendas. The article drew attention to the concerns voiced at Berkeley in 1998 about a deal by the University of California with Novartis where for $25 million investment, Novartis would receive first rights to roughly one-third of the discoveries arising from the research undertaken in a specific department in the University. This example was only one which raised a more general concern that contracts with industry which "direct" research constrain the free-flow of information and where they capture intellectual property are distorting access to research outputs for the public good. In particular, increased concern has been focused on the "privatisation" of research outcomes in the health field where monopoly rights granted on biotechnology patents are seen to be restricting access to medicines to only those who can

[2] Eyal Press and Jennifer Washburn, "The Kept University", Atlantic Monthly, 2000.

pay. Developments in this area have been brought into stark focus in relation to the provision of medicines for developing countries. There is an increasing debate on the question of the balance between public good and private interest particularly in the area of biotechnology and genomics.[3]

15. Not only are there fundamental issues of principle to be addressed in the relationship, there are many operational and practical issues which need to be addressed to make the relationship work in practice. While both sides can benefit from working together with industry getting access to leading edge research and bright people and universities getting access to real world-problems and research funds and often access to new facilities and research equipment, the relationship is fraught with difficulties. The Lambert review[4] in the UK sets out the barriers as perceived by each side very clearly.

Table 1. Perceived Barriers to Working Together

Barriers by Business	Barriers by Universities
Poor customer service	Industry will not pay correct price for research work
Poor project management	Difficult to work with SME's
Poor delivery to timetables and deadlines	Difficult negotiations on contracts
Difficulty of knowing who to contact	Changes in business strategies and priorities
Aggressive attitude over intellectual property	Lack of acknowledgement of value of intellectual property
Emphasis on publication	Changes in personnel
Working in silos	Short-term funding
Poor institutional management and governance structures for decision making	

16. The views set out in the Lambert report are based on some 50 responses from UK industry and 80 from UK universities. It is clear that many of the perceived barriers come from the underlying motivation and the fundamental mission of business compared to the universities.

17. A major area of difficulty lies in the difference in attitudes to intellectual property (IP) which has become the third area of business relationships where there is increasing difficulty. In many ways this is seen to be the area of greatest difficulty for while there is no doubt about the role which universities should and can play in education and research, there is no universal acceptance about the role which universities should take in technology transfer. As industry has reduced its role in undertaking fundamental research and universities have

[3] The Royal Society, "Keeping Science Open: the effects of intellectual property policy on the conduct of science", April, 2003.

[4] Ibid

become the source of major new technologies in the knowledge economy a whole new relationship has been forged. The first formal acknowledgement of this relationship took place with the enactment of the Bayh Dole act in the USA in 1980. The act was designed to address a perceived failure in the economic system.

18. The concept of utilizing university research capabilities to advance national goals in the USA arose as a result of the contribution the university sector made in the interests of national defence during World War II. That experience emphasised the need for a strong commitment to partnerships and linkages among industry, academia and government research sectors. The value of university research as a vehicle for enhancing the economy by increasing the pool of knowledge which could be used by industry through support by the government was first recognised by Vannevar Bush, the Science Policy Adviser to President Roosevelt in the 1940's.[5]

19. In the late 1970's it was realised however that the objective of obtaining public benefit from research funded by tax dollars was not being recognised. Some 28,000 patents had been filed on reported inventions but few had been licensed to the private sector for development for the market because being federally owned, they could not be licensed exclusively. The Bayh-Dole Act not only gave universities (among others) the first option to retain title to any invention resulting from research conducted in whole or in part with Federal funds, it gave them the obligation to bring such inventions to the market place. The Bayh-Dole Act had major implications for the function of universities and their relationship with industry. For example whereas in 1972 only about 30 universities in the USA had technology transfer programmes, today there are about 300. More importantly, the Bayh-Dole Act's provisions set the framework for the relationship between US universities and industry in terms of both research and technology transfer.

20. Bayh-Dole set the terms of ownership for intellectual property and allowed for a standard rate at which industry was expected to pay for university research. This removed at one stroke the two major areas of frustration, acrimonious negotiation and dispute that frequently exists in other parts of the world. Similarly it specified the approach which should be taken by the technology transfer function in regard to its handling of inventions. Inventions must be reported to the Federal Agencies, and the university must within a set time opt to retain title and manage the invention. Where a patent is licensed, the income derived from that must be shared with the inventor(s) and the balance used for research or educational purposes.

21. While the Bayh-Dole Act did not eradicate the challenge of bridging the gap between universities and industry, it did provide a national operational framework which is clearly specified and understood by both sides, thus removing any room for dispute. Where such a framework does not exist, each transaction becomes subject to the approach of the individuals on each side of the table. In this context in particular, perceptions and pre conceived positions are brought into the negotiation frequently making the gap between universities and industry more challenging. Mintzberg in his study of business behaviour and adoption of business strategy describes this as "strategy as perspective".[6]

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5 Howard Bremner, "Technology Transfer: the American Way", International Patent Licensing Seminar, Tokyo, Japan, January 2003.

6 Henry Mintzberg, "Five P's for Strategy", California Management Review, Fall 1987.

"*Strategy is a perspective - its content consisting not just of a chosen position, but of an ingrained way of perceiving the world. What is of key importance is that strategy is a perspective shared by members of an organisation.…… when we talk of strategy in this context, we are entering the realm of the collective mind - individuals united by common thinking and / or behavior*."

22. The attitude towards business and entrepreneurs was shown up in a survey undertaken in Scotland in the mid 1990's [7] where university faculty were asked about the values which entrepreneurs and academics saw as being important.

Table 2. Academic Perception of Entrepreneurs

Attitudes - %	Self	Entrepreneurs
Cares about people	92	9
Willing to take risks	44	91
Puts work before family	29	73
Dynamic	44	76
Focus on money	5	89
Independent	85	67

Table 3. Academic Attitudes to Commercialisation

Attitudes	%
Being a good teacher	81
Increasing Knowledge	61
Publishing	53
Academic Reputation	36
Applying Research	25
Working with Business	19
Making money	11

23. Although these figures may have changed in recent years they reflect the underpinning attitudes which come through in the recent Lambert review of university – industry relations in the UK. Fundamentally, academics and business entrepreneurs have divergent world views and value systems which mean that the starting point for any relationship is one of difference and distrust which frequently results in hostility as negotiations develop.

24. This is not just about personal relationships but influences the way in which each side enters into a potential business relationship. This can be dramatically illustrated in an examination of the technology offerings which clearly illustrate that this underlying value system can create a barrier to communication.

[7] Technology Ventures Scotland, "Report of the Commercialisation Enquiry", 1996.

25. Technology Licensing: Where universities advertise their technologies on the web-site to attract a business proposition can be examined not only for what is said but how those underlying values colour the presentation.[8]

Table 4. Technology Descriptions – Views from Two Sides of the Relationship.

University Offering

Technology Description: This technology, combining the use of a light-producing gene from the American firefly and a chemical bromide, is developed as a broad-based therapeutic approach to the treatment of cancers and infections. Concept: In recent years, photodynamic therapy (PDT) has emerged as a promising tool in both antiviral and cancer chemotherapy. In the presence of light of the appropriate wavelength, a photoactive molecule absorbs light and inactivates the virus or destroys tumor cells. Hypericin is an example of a photoactive chemical that has shown these properties. However, PDT cannot treat regions of the body impenetrable to light. Thus, two needs exist: 1) a method for targeting PDT at viral-infected cells and or tumor/cells, and 2) an energy source connected to photoactive molecules so that PDT can work in all regions of the body. Luciferin is an effective photoactive energy source which emits light in the 520-68nm range. Hypericin is photoactivated by light in the 540-660nm range. Therefore, luciferin and hypericin is a suitable pair of an energy source and a photoactive molecule.
Potential Applications and/or Markets: Example Use in HIV treatment: T-Cells from an HIV infected host are isolated and transformed with a plasmid construct containing the luciferase (light-activating) gene from the North American firefly and a promoter sequence that is transactivated by virus replication. HIV TAR and EAIV LTR are examples of such promoters. Once transformed, the T-cells are reintroduced into the infected host. The host is also injected with tethered protein, which increases the efficiency of the following reaction. After the introduction of the transformed T-cells and injection of the luciferin -hypericin tethered protein, the HIV virus replicates and activates the transgene, causing (1), causing luciferase production. The luciferase enzyme then activates the injected luciferin protein, resulting in light emission (2). The injected photo-active hypericin absorbs light and singlet oxygen is produced. The singlet oxygen, in turn, inactivates HIV replication.
Stage of Development: The technology has been proven in vitro using Equine Infectious Anemia Virus (EIAV) which has similar genetics to HIV. Three patents have been issued (5,780,287; 5,786,198; 5,952,311 and 6,160,024 issued 7/14/98; 7/28/98; 9/14/99; and 12/13/00). We are seeking a collaborative partner for mouse and other in vivo studies.

What Business Might Have Liked To Have Been Offered

"This technology enables the development of a treatment for HIV which might be in the form of a course of injections and will operate by delivering PDT at the infected cell triggered by replication of the virus It will have advantages over ……

[8] Philip Ternouth "unpublished report to the Australian Institute for Commercialisation", IPR Ltd, 2003.

To develop the treatment it will first be necessary to prove efficacy in mouse models"

26. In translating the technology from "science" to "application" and turning the proposal round to face the market it is important for this to be considered from the point of view of business, this might be done by asking questions such as:

- What is the target product for the intended licensee?;
- What unique capability does the technology give the product?;
- What is the intended modality of treatment?; and
- How does it compare with other treatments?

27. The statement can then be summarized to make a proposition which any relevant business can readily assess and decide whether it is of interest. As soon as the business development person from industry reads this they know what the intended product is, how it is intended to work, what competitive advantage is claimed for the technology which is conferred on the product and whether the next stage is of use to the business. If at that point the business is interested they will be prepared to take some time to understand the technology, however they are unlikely to spend the time understanding the technology just on the chance that it might be of use and fit with their business strategy.

28. The example given here is just one of thousands of technology postings that are on university web-sites around the globe. Most universities find that their web-sites are not very effective in obtaining licenses for their technologies. Given the nature of the web- postings encountered it is clear that there is a fundamental communication issue which needs to be addressed. There is also the question as to whether it is the university's role to make its technology accessible for business or rather industry's role to understand the science coming out of the university. One certainty is that as long as neither makes the effort to "translate" to the language of the other, universities and industry will continue to talk "past" each other.

29. There are many more examples of similar dissonances between universities and industry which can illustrate the extent of the barriers to building strong and mutually positive relationships. However, because the quality of the relationship has been under question for a considerable time there are many examples of innovative approaches which have been developed to improve collaborations. The following section presents three examples of initiatives that have been put in place with such improvement in mind.

IV. EXAMPLES OF BREAKING DOWN THE BARRIERS

30. The three examples given here illustrate some ways in which universities and industry have begun to work together to narrow the gap between their respective worlds.

31. The Intellectual Capital Partnership Program of the University of Georgia System, ICAPP® At its November 1995 meeting, the Board of Regents of the University System of Georgia approved the report of a team of consultants, which included a recommendation that the University System undertake a comprehensive assessment of human resource and employment needs for Georgia. The results of this assessment would form the basis for making decisions to approve new programs at Universities. The ICAPP® programme in Georgia was created to address the needs of local industry with the supply of appropriately qualified graduates. ICAPP® was created to help employers succeed in Georgia. The ICAPP® Strategic Response Initiative creates model academic programs to address the shortages of specific professionals in Georgia. ICAPP® is company-focused, and is not intended to create new degree programs at institutions. The programme can be summarized under three headings:

- ICAPP® Advantage helps businesses reduce their operating costs by reducing the cost of hiring and training employees. ICAPP® Advantage is Georgia's economic development incentive program that expedites the education of knowledge workers in high demand and low supply so that businesses get the talent they need to succeed. The first company helped through ICAPP® in 1997 estimates that it has saved nearly $8,000 in training and hiring costs per employee hired. ICAPP® Advantage prepares people to be knowledge workers (workers who generate value for others by creating, sharing or using ideas) in occupations that are in high demand and short supply in specific regional labour markets. ICAPP® Advantage is directly tied to specific job commitments by employers;

- ICAPP® Innovations helps colleges and universities develop courses and degree programs to meet the needs of Georgia's employers. Georgia is a pioneer in using supply and demand analysis to anticipate the demands of the labor marketplace; and

- ICAPP® Access: ICAPP® provides user-friendly, "one-stop shop" access that makes the resources of the University System easily available to Georgia businesses. GeorgiaHire.com and the ICAPP Catalogue of University System of Georgia Centres, Institutes and Special Programs are products of ICAPP® Access.

Table 5. ICAPP Advantage® Results

ICAPP Advantage Stats, 1996-2000	
State Funding	$11.7 million
Private Funding	$ 5.8 million
New Jobs	6,600
Georgians Educated Through ICAPP	2,400
Average ICAPP Funding Per Job	$1,800

V. IBM - UNIVERSITY RELATIONSHIPS, EXTRACT FROM THE IBM RESPONSE TO THE LAMBERT REVIEW, 2003

32. Across the world, IBM Research has significant collaborations with well over 100 universities, and less intensive connections with many more. What IBM Research looks for is access to the know-how in universities, sometimes in the form of help in solving on-going problems (i.e. leveraging limited resources), but more often as a way to keep abreast of new developments. It follows that most of these collaborations tend to be of an exploratory nature, with world leaders. Several UK universities qualify almost across the board. Others have pockets of international excellence.

33. It follows from the foregoing paragraph that at any time there will be relatively few substantial UK university relationships with IBM. As a general rule, money transfer does not feature highly. Also, though there are opportunities for scientists to take 3 to 12 month sabbaticals on campus, Research prefers its scientists to work inside IBM labs.

34. Complementary and collaborative research is just one of four particular interests IBM has in the university sector. The others are: recruitment of more of the best first degree, doctoral and MBA graduates; improved student and academic familiarity with IBM products; and increased profitable sales of IBM products and services. During the turbulent ‘90s, IBM’s traditionally strong university relationships in all these areas slipped. In 1998, concerned at this, IBM’s then chairman Lou Gerstner personally launched a pro-active, co-ordinated approach to university relations, with particular emphasis on attraction of top technical talent. On the premise that a well-organised whole can be stronger than the sum of the parts, a Corporate Director for University Relations co-ordinates these separate line-of-business interests, world-wide At national levels, Country General Managers oversee their key national university partnership relationships. With country-level support, these are led by senior executives, typically vice-presidents or similar. They maintain regular contact with their respective vice-chancellors and lead campus teams of keen volunteers and line of business representatives. Over the past five years, seven such partnerships have been launched. Their success is dependant on long-term people-driven relationships. In almost every case both parties are pleased with progress. Only when one or both parties are unable to provide top-down leadership does a relationship falter. After people, awards are probably the next most important part of IBM’s university relationship programme.

35. Last year, UK universities won a substantial proportion of the world-wide equipment grants made to support key corporate research priorities. These priorities are reset each year. It has been pleasing to see how the UK awards have leveraged significant UK Research Council, OST and EC funding for national priorities. Though practicality limits the number of these formal partnerships.

36. IBM in the UK has strong connections with a further twenty universities, with particular interest in recruitment but in several instances significant collaborations in subjects like Grid and e-science. Our experience of the way UK universities relate to IBM is generally favorable; with the principal determining factor what both sides are prepared to put in. The annual IBM UK Technical Ambassadors Competition never fails to amaze respecting the way

it reveals the extent of IBM voluntary university activity. Across the country, up towards 200 IBMers contribute to University Relations, touching many hundreds of academics and several thousand undergraduates. Further, though we do not track additional one-to-one Research connections, we know these numbers to be very large.

37. Examples of best practice in business-university collaboration: in notably differing ways, and usually moving up a learning curve, we see good practice in each of those seven uk universities with whom we have established long term relationships. To a lesser extent, the same applies in most of the other twenty. An important feature is that success springs from people rather than money. Particularly notable is the way strategic research and collaborative development has been promoted in certain universities, including grid, e-science, open source and life sciences. We believe that good complementary collaboration on open source and open standards will benefit our mutual customers. We are particularly proud of the way to which universities have appointed numerous ibmers as voluntary visiting honorary professors, guest lecturers, mentors and advisory board members, though we sometimes feel the last of these could be more effectively used. We find that bottom-up campus presence and one-to-one relationships are vital. So too is top down management involvement. Each of our approximately 150 university partnership teams across the world is led by a vice-president or equivalent. Regular internal team reviews improve effectiveness and commitment. In the uk, the country general manager chairs a bi-monthly meeting of partnership executives and relevant line managers. This degree of attention goes right to the top of the company: By way of example the senior vice-president ultimately responsible for university relationships is visiting at least three of our preferred uk universities over the next thirty days.

VI. THE KNOWLEDGE HOUSE

38. The Knowledge House connects business, industry and individuals with the skills, expertise and resources available within the Universities of the North East of the UK. It forms a unique access network for product, process and people development solutions. Established in 1995, Knowledge House is a collaborative venture between the Universities of Durham, Newcastle, Northumbria, Sunderland, Teesside and the Open University in the North. Knowledge House offers expert solutions for developing ideas and solving problems through collaboration, consultancy, training and research. Knowledge House is staffed by dedicated business professionals who will discuss specific requirements and quickly identify appropriate assistance from within the Universities. Once engaged, Knowledge House will ensure the smooth delivery of the agreed work programme through:

- Rapid and confidential response service;
- Free initial search and diagnosis;
- Sources of Assistance within the Universities; and
- Project management.

39. Examples of specific areas of service include:

- UniManufacture, which provides access to expertise covering a wide range of Manufacturing and related issues. Assistance can be provided for the implementation of existing, new or advanced technology for engineering and manufacturing;

- UniTrain, which helps to access the diverse range of short courses available through the region's universities. This resource will enable the definition of the specific training or development needs for the company and its staff;

- UniGrad, which provides easy access to a number of initiatives which aim to encourage smaller businesses to employ graduates and which offer help and advice to graduates and undergraduates about career options;

- UniLife, which provides access to a wide range of services and facilities for the life sciences and environmental industries;

- UniDesign, which provides access to the universities of the North East's comprehensive and impressive design and development expertise;

- UniICT, which offers access to expertise for the effective and efficient development and utilisation of the latest Information and Communications Technologies (ICT);

- UniLytical / UniTest, which offers a comprehensive range of services tailored to the needs of process, manufacturing and industrial companies; and

- UniTronics, which provides access to comprehensive electronics and electrical expertise, together with associated equipment and facilities available within the region's universities.

40. In addition, Knowledge House can provide financial assistance to small and medium sized enterprises (SME’s) located in the North East of England, to fund projects carried out within any of the region’s universities up to about 35% of the project’s cost.

VII. CONCLUSIONS

41. Links between universities and industry are challenging to manage because of the differences in the underlying motivations and rationales for such relationships to exist at all. Links have been made ever more difficult as the inter-dependency between universities and industry has grown as economies have changed and the demands on both parties have become explicit rather than casual. The perceptions and attitudes on either side of the relationship are influenced by the value systems held and the perceptions that accompany them. It is possible, however to encourage the development of more positive relationships with effort and

creativity on both sides as the examples have shown. A more fundamental question remains however, and that is whether in bridging the gap, some of the distinctive roles may have become blurred to the detriment of both parties. Clarity of mission and purpose and an understanding that it is often the differences rather than the similarities in partnerships that provide the greatest rewards, can assist in bridging a sometimes substantial gap.

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